1. Course number and name
   ENGR 478: Design with Microprocessors

2. Credits and contact hours
   4 credit hours; three 50-minute lecture sessions/week and one 2-hour-45-minute lab session/week

3. Instructor’s or course coordinator’s name
   Instructor: Hamid Mahmoodi, Assistant Professor of Computer Engineering
   Course coordinator: Hamid Mahmoodi, Assistant Professor of Computer Engineering

4. Text book, title, author, and year
   a. other supplemental materials
      (none)

5. Specific course information
   a. brief description of the content of the course (catalog description)
   b. prerequisites or co-requisites
      Grade of C or better in ENGR 356
   c. indicate whether a required, elective, or selected elective course in the program
      Required for Computer and electrical Engineering.

6. Specific goals for the course
   a. specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a particular topic.
      • The student will be able to describe internal organization of ATMEL AVR microcontroller.
      • The student will be able to perform hardware and software interaction and integration.
      • The student will be able to design microprocessor interfacing.
      • The student will be able to design microprocessors/microcontrollers-based systems.
      • The student will be able to develop microcontroller software in assembly and C language.
      • The student will be able to utilize various dedicated functional units inside the microcontroller such as timers, interrupts, Analog-to-digital converter, and Serial port interface.
b. explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
Course addresses ABET Student Outcome(s): b, c, e, k.

7. Brief list of topics to be covered
- Introduction to Computing
- The AVR Microcontroller: History and Features
- AVR Architecture and Assembly language Programming
- Branch, Call, and Time Delay Loop
- AVR I/O Port Programming
- Arithmetic, Logic Instructions, and Programs
- AVR Advanced Assembly Language Programming
- AVR Programming in C
- AVR Hardware Connections and Flash Loading
- AVR Timer Programming in Assembly and C
- AVR Interrupt Programming in Assembly and C
- AVR Serial Port Programming in Assembly and C
- LCD and Keyboard Interfacing
- ADC, DAC, and Sensor Interfacing
- Relay, Optoisolator, and Stepper Motor Interfacing
- Input Capture and Wave Generation in AVR
- PWM Programming and DC Motor Control in AVR